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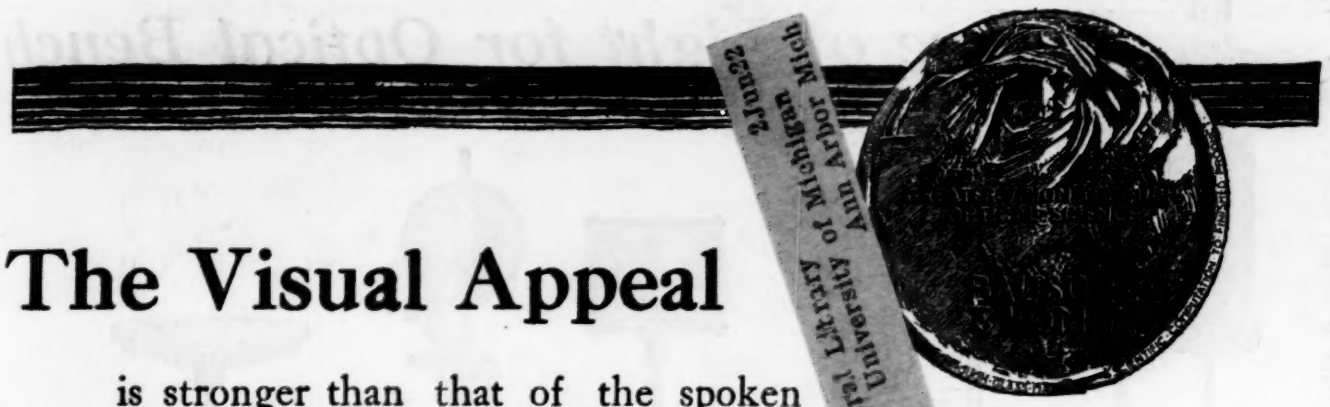

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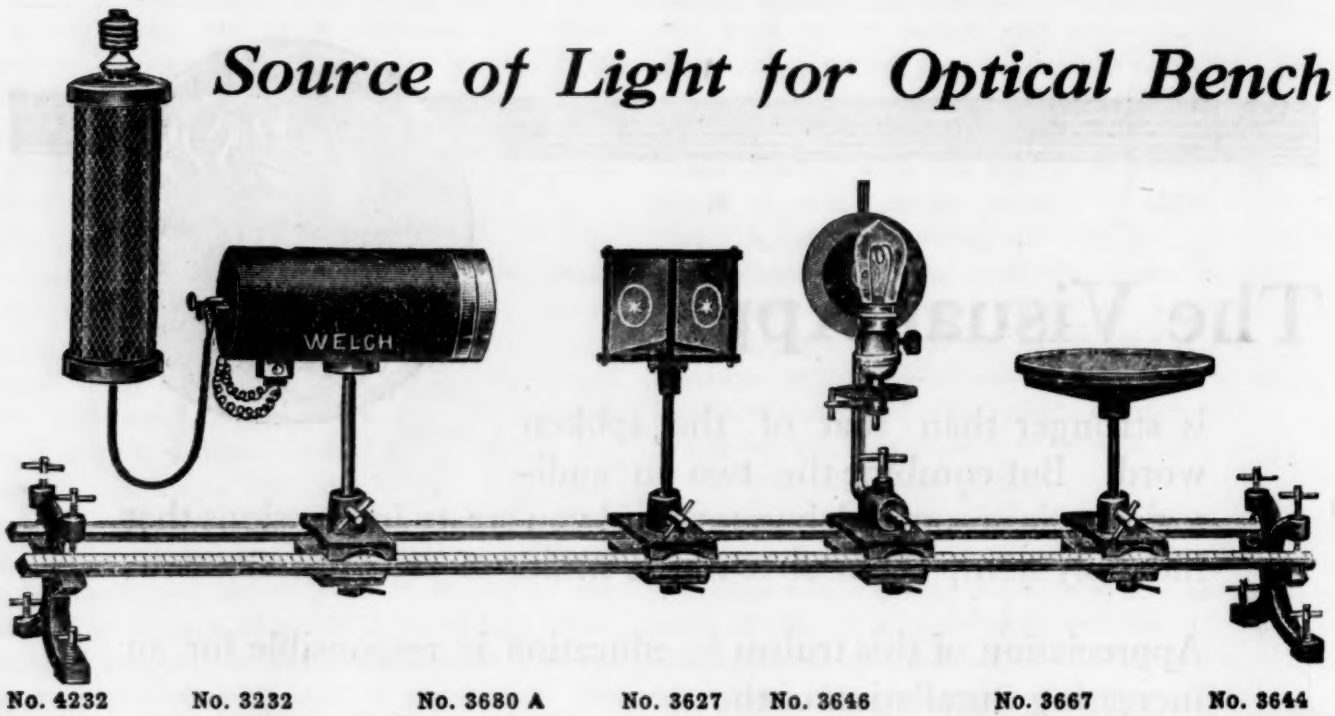

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THE ANTHROPOLOGICAL PROBLEMS OF THE FAR EAST[1]

THE white man is quite liable to forget that the Far East is a very great part of the world; that it is, in fact, a more populous and greater world than his, and one which has perhaps quite as many and important problems of its own. But it is difficult to realize these things unless the student actually visits the Far East, and by Far East I mean the entire eastern half or rather two thirds of the Asiatic continent with the adjacent oceans. Once you enter these territories you are in a vast human beehive; you see on all sides of you peoples of interest; peoples who must have their history, their antiquity; peoples who must have many problems the solution of which is connected with and would be of value to the rest of the world. When, as an anthropologist, you have been in these regions for a length of time, you begin to see a light, very dim at first, which shows you these problems, so far as our own field is concerned, are divisible into two large classes: into the more *comprehensive* ones, which involve very large groups of humanity and the large questions, and into the more *particular problems,* which are proper to the different individual ethnic groups that occupy those territories.

I shall speak first of all of some of the more individual problems, but it may as well be stated at once that with these or the larger problems I shall not be able to do more than to present mere outlines for your contemplation; more thorough definitions and the answers to the problems are matters for the future.

It will be handiest to take up the particular questions geographically, and begin with the north or rather the northeast. And here we

[1] Lecture delivered before the 548th meeting of the Anthropological Society of Washington, October 19, 1920.

encounter first a fairly large group of people who present physical and other features that in many respects ally them closely with the American Eskimo. They are the Chukchee and related tribes. Those who have seen living representatives of these people, or only their portraits, and who at the same time know our Eskimo, could not but have been struck forcibly with not merely the close resemblance, but the physiognomic and general physical identity of the two groups. But what is the real connection between them we do not know. It would of course be easy to jump over the bridge and say that both people sprang from the same stock, but that would be an opinion, not a demonstration. We know that in early historic times the Asiatic "Eskimo" traveled over the Behring Straits on to the St. Lawrence Island and probably to the American side of the straits; and we also know that some Eskimo from this side traveled in the opposite direction, but that does not yet establish their identity. A good deal of creditable work has been done on the Chukchee by Russian scientists, but the actual determination of the main facts is still in abeyance and the whole constitutes one of the attractive problems of anthropology for the future.

Another interesting ethnic group in the Far East about which we know but little, even less than about the Siberian "Eskimo," are the natives of Kamchatka. They are not so much like the Eskimo, although we find amongst them individuals who approach Eskimo physiognomy more or less; but one may perceive among them again and again the physiognomy or an approach to the physiognomy of the American Indian. Recently a Swedish expedition with, as reported, ample means and intending to stay in the field for at least two years, has proceeded to the peninsula with the object of studying the people as thoroughly as possible; but the group should be and will probably have to be studied as well by Americans who are well acquainted with the Indian.

As we proceed farther south we come to another interesting group of people now almost extinct, which however to this day presents its problem to anthropology, and these are the Aino. It is often supposed that the Aino are native to little more than the island of Yezo in Japan, but that is an incorrect localization. They occupy to this day parts of the Kuriles Islands and Saghalien, and they occupied in early historic and prehistoric times the entire Japanese archipelago, excepting perhaps the southernmost portions. Here are people who differ considerably in their physique from both the Chukchee and the more Indian-like people of the Kamchatka peninsula. They evidently have in them a considerable mixture of white blood; in addition to which they unquestionably have also a proportion of yellow-brown, the stock which now prevails over all these regions. It is known that they occupied the Japanese archipelago before the Japanese reached that country, though they may not have been there very long: and there are some indications that their inflow into Japan may have been from the north. But all this is still problematical, together with their influence on the actual Japanese, and calls for further investigation.

Another interesting group or rather conglomerate of people in the north of the Far East, are the Tunghuz. These can no more be regarded as a single tribe. They embrace, from the physical standpoint at least, people of decided differences. The Tunghuz of the south are unlike the Tunghuz of the north. The southern Tunghuz, or at least certain groups of them, resemble the American Indian so much that the student can not but be struck most forcibly by the fact. It is such a resemblance, in color, physiognomy and all features of the body, that we can not but feel there must be here an identity of stock, and a unity in perhaps not a very far distant past. These tribes are now in their decline, and they are crying for a thorough investigation from every anthropological standpoint. True, there are some Russian accounts of them, but they are only partial, insufficient. It would seem self-evident that in a case of such important disappearing people we should have casts as well as plenty of photographs and

measurements in order to preserve the characteristics of the group to science and history, for in another generation or two they will be completely mixed up and extinct. They are going rapidly like many of our American tribes and unless promptly studied we shall before many years long in vain for satisfactory records. Here is a problem which calls for immediate attention, a problem of much more than a local or even only Asiatic interest, something indispensable to American anthropology; and one remembers with pity the recent resolutions relating to the problems of the Pacific made at the Congress of Hawaii, among which questions like this were wholly forgotten.

A little farther south, we come to still another interesting and important group, in the process too of becoming anthropologically spoiled by amalgamation—the Mongolians. The term "Mongol" applied to many of the Asiatic peoples is of course a misnomer, much as when we call all white people "Caucasian" or "Aryan." The Mongolian people who extend over a large region to the south of Lake Baikal, and admixture with whom is very evident in some parts of China, are, like the Koriaks and the Tunghuz, remarkable for the frequent occurrences among them of types that resemble, and at times resemble to the point of identity, the American Indian. Besides this, you will find among the Mongolians not a few indications of admixture with white people. You will find, especially in the western part of the territory, individuals with blue eyes and brown hair and white skin. And in southern Mongolia the people have become mixed with other branches of the yellow-browns that do not so much resemble the American Indian. Here surely is a stock that calls for investigation, not merely physically but also linguistically and in other directions. They speak five chief dialects or languages; they sing songs that are purely Indian in sound and character, and they do many things like the Indian. One night, being absorbed in my work, and hearing a Mongolian pass, singing as he went, I just simply became confused; it seemed I must be somewhere in America amongst the Indian tribes. Whether the words were alike I do not know, but the sounds were identical. They are like the Indians in many habits—for instance, you will find piles of rocks in the mountain passes accumulated through ages by the traveling Mongols, precisely as you may see in parts of our Sierras where they have been piled up by the Indians; and they do exactly as the Indian does when he reaches the summit of the pass—they take up a pebble, offer a short prayer, spit on the stone, pass it over their legs, return thanks that they have reached the summit, and pray that they may reach the end of their journey in good strength and safety. This is exactly what the Pueblo Indian does in our southwest, or the Peruvian Indian in the Andes. And this is but one instance out of many such resemblances between the Mongolian and the American Indian. They extend to personal and even religious observances, notwithstanding the fact that the Mongols have long been converted to Lamaism, one of the most exacting and intolerant of religions. So here again there is a series of problems which urgently calls for investigation, and they are problems connecting directly with the American, and hence calling for the student well acquainted with the American Indian.

We come now to the more cultured and better known groups of the Japanese, Koreans, Chinese, Indo-Chinese, Burmese, Hindu, etc., and every one of these groups teems with problems that need investigation.

Take Japan for instance. To this day the origin of the Japanese people is in considerable haze. It is supposed that their main line of ancestors, in all probability of mixed Tunghuz derivation, came about 1,000 years B.C. or a little over, from somewhere in eastern or northeastern Manchuria, and very likely also southeastern Siberia. But it is also perceptible in Japan, especially among the female children, that there has been some infusion of an Eskimo-like type. In all probability the "Tunghuz" carried with them some elements of the Asiatic Eskimo. You may find little girls in the streets of Tokyo

to-day who have perfect Eskimo features, and you will find this feature occasionally in the adults as well. The Japanese know it, but whether they are not willing to admit it, or simply have not pronounced themselves upon this point, they have never offered any explanation. It seems that the invading stream was derived from a large part of the northeastern region, that after passing around or through Korea they reached the main island of Japan, settled then by the Aino, and that possessing better military art and weapons, they prevailed over the Aino partly by uniting with them and absorbing them, and partly by destruction. The Aino have survived only in the north, and to-day not only are they few in number but it is practically impossible to find a full-blood among them. But this was by no means all of the origin of the Japanese. Before even the Aino came, there apparently was in the southern portion of the islands a neolithic population. The Japanese collections contain now some skeletal remains of these people, and these show that even then there was already a diversity, though the general type is that of a yellow-brown people, who must have penetrated into southern Japan at that time from Korea or the continent. And there is another element, not traceable so far historically, that apparently came from the south. Whether it came from Formosa, or from the Chinese coast or even from the Philippine Islands is not known, but some facts would point to the Philippines rather than to Formosa. This southern element is responsible for bringing into Japan certain cultural features, and physically a few traces of the Negrito. To this day you will find Japanese—rarely yet occasionally—who bear physical traces of negrito admixture. They are it seems ashamed of it. The Japanese anthropologists are aware of the fact, but it has received no further attention. In addition there was a more important influx of Chinese and Koreans, and also since early in historical times there was a slight influence of whites. Just what part these different elements played in the building up of the Japanese people remains to be determined. Also, there are still many old mounds and sites in Japan that demand careful exploration. The Japanese anthropologists are slowly working in these directions, but they must necessarily lack the perspective that could be brought to the field by the American student. For this and other reasons it would be better if scientists from this continent as well as from other parts of the world would participate in the work.

The Koreans too, present a field for much further research. Though yellow-browns, they are a distinct people from both the Japanese and Chinese. They resemble greatly some of the more western Russian Tartars. The Japanese in general, for political reasons, are rather anxious to convince the Koreans as well as others, that the Koreans are the same as themselves, but the scientific observer sees readily substantial differences, at least as large as are those between the Koreans and Chinese.

In China itself there are still many problems for anthropological investigation. In the first place is the origin of the great Chinese people, counting to-day between three and four hundred million individuals. We know that their ancestors came from somewhere in the northwest; that they mixed with people already in the country, the so-called wild tribes and others; that later they impinged upon and perhaps mixed slightly with the Negritos of the south. But none of this is as yet fully cleared or established, and there are many other questions. There are in southwestern China groups some of whom are not yellow-brown but rather Indonesian or of Hindu derivation, much nearer to white people than the Chinese. We find also considerable physical and other differences between the Chinese of the north and the Chinese of the south. These remain to be investigated. There are large districts where there are remains in the nature of mounds, or burial caves, or sites, which have hardly yet been touched. Also there are unknown tribes in the western mountains. Some of these tribes have been mentioned by explorers, but none have been investigated anthropo-

logically, and what is true of the western part of China is even more true of the neighboring Tibet. The southern portions of Tibet are the least desirable anthropologically because they are the most mixed, and they have been investigated to a certain extent by the English. The real Tibetans live more in the center and towards the northeast of the great region, and among them again one finds the physiognomy of the American Indian.

South of China are masses of mixed population; but there is one prevailing group that needs careful attention, and that is the Malays. These people are found in Borneo, in Java and the rest of the Malay Archipelago, in the Philippines and elsewhere, besides on the continent, and we still lack a knowledge of them which would enable us to say precisely what they represent, and which would enable us to join them more directly to other branches of the yellow-brown people.

Here in the south we find too one of the most enigmatic of all the now existing groups of humanity, namely the Negrito. There are indications that at one time the Negrito occupied a very much larger territory than he occupies to-day, that he was in other words a much more important anthropological group than he seems to be now. There are to this day Negrito settlements in the little islands off the southeast of Formosa; there are traces of them in southern China, and more in Burma and Indo-China; they people the Andaman and the Nicobar Islands off the coast of India, and there is a large remnant of them in the Philippine Islands, especially on the island of Luzon. But they, or traces of them, exist also in New Guinea, and in many of the islands of Micronesia, Melanesia and even Polynesia. Therefore the opinion is justified that the Negrito at one time, before and during the influx of stronger peoples from the northwest, played an important part in the peopling of Asia. But we still do not know just where to place the Negrito. Is he allied to the African Pygmy? or is he a separate development? That he has some connection with the Negro is certain, but how can this connection be explained? And when and whence has he reached the territories he peopled? If any human group should be thoroughly known, it is surely the Negrito; but he is receiving nowhere near the attention that he deserves. Here again there is a fertile field for investigation.

As we proceed eastward we now approach the great group of Polynesians. This is the particular group that is just now receiving so much attention; but I am afraid that some of this attention will be misplaced, for it can not lead to any great results. In the first place it is well known that the peopling of Polynesia is quite recent; in the second place nothing has ever been found on all these islands that would justify a belief in anything more ancient. Furthermore, and this is perhaps the most important, any one who has had any direct acquaintance with the Polynesians must readily have recognized that they are a mixed people. There are individuals among them who resemble more or less the American Indian, while others represent more the Malayan type of yellow-browns; there are those who clearly approach the white man; and there are numerous individuals who bear traces of the Negrito or Negro. Now, a mixed population of this nature, and of recent historical derivation, can not yield a great deal to anthropological research. There are undoubtedly problems of interest in the study of the Polynesians, but when we contrast them with those of the rest of the Far East, we can not but perceive that the Polynesian problems have not a primary importance.

A more important set of problems are those relating to Australia. We have heard much about the "Australian race," but it is very doubtful if there is any such thing as an Australian *race*. If we compare the natives of one part of Australia with the natives of other parts, we see such differences that physical unity can scarcely be contemplated. They have of course been territorially circumscribed and they have intermixed; they have numerous customs in common, though they also differ in this respect; but they are probably not one people. They have commonly been talked of as "the Australian"; they should rather be dealt with as the "Australians." The anthro-

pologists have further sinned against the Australians by classing them as but little higher than the anthropoid apes. Because some of them present various primitive features, such as marked supraorbital ridges or pronounced prognathism, they have been placed on the lowest rung of the human scale. This is not yet fully justified. The Australian demands a lot of new careful, unbiased investigation, and he demands it urgently for he also is disappearing—not by amalgamation, although that also exists in some parts—but through habits and diseases introduced by the white man.

From Australia there is but a step to Melanesia, which too, presents its problems; the main one being perhaps the advent into these regions of the African Negro. Most if not all the groups show individuals who are regular types of the African Negro in physiognomy, character of the hair, stature and all other respects. This is a big negro, not the small Negrito who was evidently always small and whose diminished stature with slender limbs has made him conspicuous even in admixtures. The type represented here, aside perhaps of some Negrito, is the real African. But how did Africans come into these far away islands? They never were navigators of any note. Were they brought there by others, perhaps the Egyptians or the Arabs? We do not know as yet. It is another problem of the Pacific. And there are others in Melanesia.

Then there are the many problems of the people of the Indies. As yet we do not know exactly what the Indian populations represent, or just how and when they came. There was a stream of "Aryans," but who were they? And just who anthropologically are the Dravidians, the Ceylon Vedahs and the other groups of importance? We see on one hand a large Mediterranean strain. There are many people in India who, if placed in a more northern climate for a few years, would so closely resemble the southern Italian that they could not be told apart. There are other Hindu who resemble the people of Afghanistan, or those of Persia, southeastern Russia, and perhaps even the Nordics of Europe. Again there are undoubted and numerous semitic elements, and then of course there are the mixtures of the Malays and other yellow-browns, and those of the Negrito. Here are many problems that await and deserve a careful further anthropological investigation.

So much in a very superficial way about the more *particular* problems of the Far East and the Pacific. There are plenty of them and they claim our special attention because as Americans we are directly interested in the eastern Asia which gave us our Indian. But these parts of the world present some greater, more *comprehensive* problems of the most stimulating and absorbing interest, which can not be solved fully before many of the particular questions shall have been answered, but which must be kept before our mind.

The first of these more comprehensive problems is that of the origin, derivation and time of coming of the yellow-brown stem of humanity. Here is a multitude of people, enough to fill three times over and more the whole American continent as it is now populated, who, though they extend from the farthest north down to the equator, present nevertheless many characteristics in common. They are not of the same color, but are all yellowish-brown, ranging from yellowish-white down to brown-black. They have all the so-called Mongolic eye, especially in the child; they are all characterized by a scarcity of beard, by black or brownish-black and wherever unmixed, straight hair, which shows also certain microscopic features that differentiate it from the hair of the rest of the human family; and there are still other characteristics that unite these people. They must all have proceeded from the same stem. But where did they originate? How, why and when did they people Asia? How did they become so subdivided and acquire their secondary differences? Notwithstanding the fact that they show so many characteristics apart from the white man, yet they show much more resemblance to him than to the blacks. There is no line of demarcation between the whites and the yellow-browns, as there is between the browns and the blacks. What is the meaning of all these facts? Here

is surely a great field for scientific determination.

But the greatest and most comprehensive of all the problems of the Far East and the southern archipelagos, is that of man's antiquity in these regions. We know that since the Tertiary these regions were and still are inhabited by anthropoid apes. We therefore have had there forms near to man since at least the Pliocene period. In the island of Java have been discovered the remains of a creature that is the closest to man of all non-human forms thus far known. Whether this being was directly ancestral to man or not does not matter; the point is that many things indicate this region as the possible site of man's earliest differentiation, of man's origin. But the truth in the case remains to be determined. Explorations in this field have thus far barely touched the surface. There are vast promising deposits, and almost endless numbers of caves that demand exploration. Of all the fields of anthropological research here is the most pregnant. And it lies fallow.

Connected with the preceding is the problem as to why early man has not populated the mainland of eastern Asia. In all this part of Asia, extending to the Turkestans, there has not been found thus far a single object which would unquestionably point to man's geologic antiquity. The objects thus far discovered over these vast regions are those of the Neolithic period, and apparently not even the oldest parts of the Neolithic. The man who occupies these territories is not allied with anything primitive; he is not very substantially different from the white man; he is more related to the white man than to the blacks; his origins point westward, not southward. The only conclusion that one can reach is that the region which is now known as China and the continent to the north of this, had never been peopled by early man, for which there must have been weighty reasons. On closer analysis it is possible to reduce these reasons to two only—either early man never was in southern Asia; or he was there in the south but was prevented from reaching farther north by insurmountable, for him, natural conditions. The fact that no trace of anthropoid apes has thus far been found in central or northeastern Asia would somewhat favor the second hypothesis. The barrier to the extension of these apes northward may have been the same that prevented a similar extension of early man or the human precursors. Though it is also possible that early man developed in the south but much farther westward, maybe even as far as the African continent. All this is to be determined. Yet certain facts indicate that, whether early man did or did not once exist in southern Asia, there did exist towards the north a barrier that might have prevented his spread in that direction. A large portion of China is covered by a peculiar Quaternary geologic formation, the so-called loess. The loess is generally poor in fossils, and geologists in China have inclined to the opinion that during the deposition of these accumulations the great region thereby covered was probably not as habitable as it is to-day; that it did not offer sufficient resources for man or many animals; that the loess formation may represent conditions such as exist in the Turkestans or southern Mongolia at this day. It appears to represent a region where the alluvia left after overflows of the rivers after they dried were disseminated by the winds and came to form the earth's surface under semi-desert conditions. But the actual facts are still to be established. This only shows how great is the need of actual investigation, geological, paleontological and from many other points of view, in these regions.

Such are at least some of the more *particular,* as well as the more *comprehensive* problems of the more eastern parts of the Asiatic continent, presented in a simple and meager manner. My object is merely to show how necessary it is for American anthropology to pay more attention to the Far East. The time has come when we must cease to be provincial. I would like to see our institutions establish proper research stations in eastern Asia where local workers could be trained for investigation in anthropology and related branches. And I would like to see the American men of science as well as others, help to establish for

China and India, the two most important centers, national Museums of Natural History which would serve as centers of anthropological, biological and geological investigation of the Far East.

Aleš Hrdlička
U. S. National Museum

SURVEYING FROM THE AIR

The great possibilities of airplane photography in connection with the water and land work of the Coast and Geodetic Survey are looming up as a potential factor in expediting the mapping of our waterways and interior surveys. This very important subject has been the object of careful study and experiments by officers of the Survey, in collaboration with the other branches of the government, during the past year and the rapid advance in aerial photography, first seriously undertaken during the war, now promises, with proper development, a method of surveying that will probably far exceed expectations over the old methods in rapidity, economy, and minuteness of detail.

No little stress should be laid on the fact that, not only are the possibilities good for an early and complete revision of our shore topography, but the opportunities that present themselves for assisting materially in our hydrographic work shouldn't be underestimated.

With the necessary facilitates and cooperation supplied by the Army and Navy Aviation Corps to the Coast and Geodetic Survey, experience has already proven the value of aerial photography over the old method of surveying in revision surveys of our coast lines.

This work so far, is divided into two branches, *Aerial Photo-Topography,* and *Aerial Photo-Hydrography,* and the results are shown in the following recent practical demonstrations:

AERIAL PHOTO-TOPOGRAPHY

In July, 1919, experiments were made at Atlantic City, N. J., to ascertain the adaptability of airplane photographs for use in topographic mapping. The area in the vicinity at Atlantic City was chosen as it is characteristic of so much of the coastal plain territory of the Atlantic coast. This project was essentially experimental in character, but developed into one of practical value, as the photographs are being used in a revision of the charts of the New Jersey coast.

This work was done in cooperation with the Air Services of the Army and Navy. Both land and sea planes were used, and in addition several photographs were made from a dirigible. Three types of mapping cameras were tried out, the "L" type, K-1, and Trilens. An officer of the survey kept in close touch with the work and furnished the ground control, constructing special targets in some cases.

A mosaic was constructed by members of the Air Service of the Army, using the photographs made with the K-1 mapping camera. These were taken at an altitude of 7,000 feet, using a lens of 10 inch focal length, with a resulting scale of about 1:8,000. A rough control scheme was first laid out, and the mosaic constructed over this.

This mosaic and also the individual photographs have been the subject of study by engineers of the survey, especially with reference to control and interpretation. Various methods of reduction for chart use were tried out. A study was made of the accuracy of mosaics and individual photographs. The possibilities of control using the photographs themselves to establish a graphic triangulation, have been investigated. The most important point brought out from the study of the results of the work at Atlantic City, was the possibilities in revision work, especially along those sections of the Atlantic coast where the shoreline is subject to frequent changes owing to the action of the sea.

AERIAL PHOTO-HYDROGRAPHY

At the same time that the experiments at Atlantic City were being made, a distinct line of investigation was being pursued at Key West, Florida. Photographs were made by the Naval Air Service to determine the pos-

sible use of aerial photographs in connection with hydrographic surveys. The primary object in view was the elimination of wire drag work, especially in the clear water of the Florida coast. An attempt was made to photograph small coral heads and pinnacle rocks, as it is the existence of these needle-like dangers to navigation that require the use of a wire drag. The equipment at the Air Station at Key West was limited, but thorough tests were made with that available. Various types of cameras were used, as well as different combinations of filters and plate emulsions. Photographs were made at altitudes of from 200 feet up to 4,000 feet, and under various light conditions. It was hoped that some combination of the various factors involved would produce satisfactory results.

The problem of control was solved, by including in each photograph, two vessels of the survey. The photographs could not be corrected for tilt with only two known points as a base, but the control as furnished by the positions of the two vessels, was found to be sufficient for the experiments.

A well-surveyed area near Key West was chosen, and the vessels proceeded on parallel courses over this area at full speed, the plane flying forth and back above the course. The courses and positions of the vessels were recorded as in ordinary sounding work. The photographer in the plane recorded the exact time that each exposure was made, with other data such as altitude, exposure, plate, filter, etc. Each photograph was later oriented by plotting the positions of the vessels on the chart at the instant the exposure was made.

These experiments proved very conclusively that photographs from the air, using present day equipment, are of little practical value to the hydrographer. When any of the underwater features did appear in the photographs, contrast in color was the most prominent, with no indication as to whether the contrast indicated shoal or deep water. Vari-colored bottom, of uniform depth, appears in the photograph as apparent difference in depth. Many charted shoals are not indicated in the photographs, while adjacent ones show clearly. Taken altogether, the results are so uncertain, that the chances of eliminating field work in hydrography are very remote. Developments in the art of photography may change this viewpoint.

REVISION OF THE COAST OF NEW JERSEY

In March, 1920, the Army Air Service photographed the coast line of New Jersey from Cape May to Seabright. A single flight was made using the K-1 camera. The plane flew at an altitude of 10,000 feet, and under very good air conditions. The camera was mounted in gimbals, with a lead weight at the lowest point to assist in maintaining the optical axis of the camera in a vertical position. Level bubbles were placed on the camera, to aid in keeping the camera in the proper position. This is the most satisfactory way to suspend the camera, and control its verticality, at the present time. The photographs are being used for a revision of the charts of the coast of New Jersey. The individual photographs are 18×24 cm. in size, and the approximate scale is 1:10,000. The photographs are mounted in strip mosaics, for convenience sake, not over four feet in length. The length is generally determined by the position of control points. This composite photograph is compared with the topographic sheet of the same area, and control points identified. The scale of the photographic mosaic is determined, and by means of the pantograph, the data are reduced to the scale of the chart, and transferred from the photographs to tracing paper.

The photographing of this 120 miles of coast line took less than two hours time in an airplane. The development of the films and printing took two days time of one man. Two rolls of film were used, a total of 183 photographs. The work of interpreting the photographs, assembling mosaics, comparison with topographic sheets, and reduction to the scale of the chart of the outside shore line required 15 days of office work by one engineer.

E. LESTER JONES
U. S. COAST AND GEODETIC SURVEY

SCIENTIFIC EVENTS

THE BRITISH NATIONAL UNION OF SCIENTIFIC WORKERS

The annual meeting of the council of the National Union of Scientific Workers was held at King's College on November 13. We learn from *Nature* that in his address Dr. J. W. Evans, the retiring president, dealt with the subject of "Research at the Universities." Dr. Evans paid a tribute to the achievements of scientific workers during the war, and pointed out that the task ahead of them was of even greater consequence and allowed of no relaxation of effort. After summarizing the activities of the Department of Scientific and Industrial Research, he expressed dissatisfaction with the present attitude of this department towards the scientific and technical faculties of the universities. He considered that a teaching staff engaged in research work, both in pure science and in its applications to industry, was in a more favorable position to discover and develop new principles than research workers isolated and restricted in the laboratories of research associations of even government research institutions. In conclusion, Dr. Evans urged the importance of universities including in any course in science some training in research methods. This he embodied in a resolution which was supported by Professor Soddy, who stated that Professor Perkin had already applied this principle to the chemistry courses at Oxford University. Chemistry students there had shown by their enthusiasm how much the change was appreciated.

Continuing, Professor Soddy said that since the president had prepared his address there had been a complication brought about by a request from the War Office that the universities should undertake research into the development to the utmost extent of chemical warfare research for offensive and defensive purposes. He expressed the view that it was a matter that must inevitably be considered, sooner or later, by the union. It ought to be considered before rather than after the occasion arose. He was glad that the executive of the union had already decided to appoint a committee to go into the whole question.

The resolution disapproving of the policy of the Department of Scientific and Industrial Research, in establishing and financing research associations, which hands over to the private use of profit-seeking monopolies valuable knowledge obtained at the expense of the whole community, and places the research associations in a position to exploit the scientific workers of the country for their own benefit, was carried unanimously. Professor Soddy stated that the government had capitulated to the big business interests in politics and departed altogether from its original intentions. There was no greater example of unfair competition than in the chemical industries.

Mr. A. A. Griffith, in moving a resolution that for the present Advisory Council of the department should be substituted a council elected on different principles pointed out that there could be little effective criticism of the department under the existing arrangement whereby the government practically appointed its own critics. It was certain that a council part of which was elected by democratically constituted scientific organizations would result in more careful scrutiny and criticism of the acts of the department.

A resolution by Mr. F. A. Potts to the effect that scientific workers employed as whole-time officials in government departments should enjoy status and pay not less than those enjoyed by the administrative class of civil servants was carried unanimously.

Professor Leonard Bairstow was elected president for the ensuing year.

PLANT PATHOLOGY AT THE BROOKLYN BOTANIC GARDEN

In the ninth annual report of the Brooklyn Botanic Garden for 1919 attention was called to the need in this country of additional provision for fundamental research in plant diseases, and to the desirability of establishing at the garden a laboratory or institution of plant pathology. This institution is strategically located for the prosecution of certain phases of plant disease research since it is at the

center of one of the largest market garden regions in the country, is at the port of entry for most of our foreign plant importations, and at the terminus for the largest domestic shipments by rail of fruits and vegetables. The plant disease problems in connection with this commercial activity are many, and are of the highest scientific interest as well as of great economic importance. These facts have been recognized by the Botanic Garden governing committee and other friends of the garden, and a fund of fifty thousand dollars has been subscribed to become available over a period of four years from January 1, 1921. It is the intention to give special emphasis to the pure science phase of plant disease problems. A curatorship of plant pathology has been established, and it is planned to erect an experimental greenhouse at an early date. Dr. George Matthew Reed, of the Office of Cereal Investigations, Bureau of Plant Industry, Washington, D. C., has been appointed to the new curatorship beginning January 1, 1921.

THE AMERICAN PHYSICAL SOCIETY

THE annual meeting (the 106th regular meeting) of the American Physical Society will be held in Chicago, on December 28, 29 and 30, 1920, in affiliation with Section B—Physics—of the American Association for the Advancement of Science. The meetings will be held in the lecture room of the Kent Chemical Laboratory of the University of Chicago.

The program of technical and scientific papers, to be given on Tuesday and Thursday, will be in charge of the Physical Society. On Wednesday morning there will be a joint session with the Optical Society of America.

The session on the afternoon of Wednesday, will be in charge of Section B, at which time Professor Max Mason, the retiring vice-president and chairman of Section B, will give an address on "From Oersted to Einstein." This will be followed by a symposium on "Recent Progress in Magnetism" with papers by S. J. Barnett, S. R. Williams and A. H. Compton.

Other meetings for the current season are as follows:

107. February 25–26, 1921. New York.

108. April 22–23, 921. Washington.

109. Time not determined. Pacific Coast Section.

DAYTON C. MILLER,
Secretary

CASE SCHOOL OF APPLIED SCIENCE,
CLEVELAND, OHIO

THE MATHEMATICAL ASSOCIATION OF AMERICA

THE fifth annual meeting of the Mathematical Association of America and the second annual meeting of Illinois section will he held at the University of Chicago on Tuesday and Wednesday, December 28 and 29, 1920, in affiliation with the American Association for the Advancement of Science and in connection with the western meeting of the American Mathematical Society. The Illinois section will meet jointly with the Association in all its sessions, but will hold a separate business meeting on Tuesday afternoon.

On Wednesday evening at half past six there will be a joint dinner at the Quadrangle Club of all the mathematical organizations, together with Section D (Astronomy) of the American Association.

The meetings will be held in Ryerson Physical Laboratory and in the physiological laboratory. The former is situated near the corner of 58th Street and University Avenue, the latter is the southwest building of the Hull Biological group near 57th Street.

It is proposed that the Mathematical Association of America should emphasize in its meetings the presentation of historical papers, and to this end it welcomes the opportunity to meet the newly organized Section L (Historical and Philological Sciences, including the History of Science) of the American Association for the Advancement of Science in two joint sessions for the reading of such papers. It is also planned that the association should encourage the presentation of expository papers of a fairly elementary character, and several such papers have been included in this program.

SCIENTIFIC NOTES AND NEWS

Dr. Edward Rhodes Stitt, head of the Naval Medical School at Washington, D. C., has been appointed Surgeon General of the Navy, to succeed Surgeon General Braisted who retired on November 26.

Dr. Whitman Cross, of the U. S. Geological Survey, has been appointed honorary associate in petrology at the National Museum, succeeding the late Dr. J. P. Iddings.

Dr. C. L. Alsberg, chief of the Bureau of Chemistry, U. S. Department of Agriculture, was elected president of the Association of American Dairy Food and Drug Officials at the recent convention of the Association at St. Louis.

In the issue of Science for November 26 (p. 505), Dr. I. C. White should have been given as president of the Geological Society of America.

Arrangements have been made by the faculty and trustees of the University of Chicago for the painting of the official portrait of James Rowland Angell, formerly dean of the faculties and head of the department of psychology at the university, who is now head of the Carnegie Corporation of New York. Mr. Ralph Clarkson, the Chicago painter who made the highly successful portraits of Professor Thomas C. Chamberlin, former head of the department of geology, and Professor Rollin D. Salisbury, dean of the Ogden Graduate School of Science, has been engaged to paint Mr. Angell's portrait and is now in New York for that purpose. Dean Angell was connected with the University of Chicago for twenty-five years.

Dr. B. Laufer, curator of anthropology in the Field Museum of Chicago, was elected an honorary member of the Finnish Archeological Society of Helsingfors on the occasion of the fiftieth anniversary of this society on November 6, 1920, and a corresponding member of the Société des Amis de l'Art Asiatique, Hague, Holland. He has recently been appointed honorary curator of Chinese antiquities in the Art Institute of Chicago.

The recipient of the Alvarenga prize awarded by the Swedish Medical Association this year was Dr. E. Hammarsten for his work describing the isolation from the pancreas of a "coupled" nucleic acid.

Dr. C. M. Woodworth, who has been making a study of the inheritance of disease resistance in flax with the Office of Cereal Investigations, U. S. Department of Agriculture, with headquarters at Madison, Wisconsin, has resigned to take charge of the plant breeding work in the agronomy department of the University of Illinois.

Dr. Carl O. Johns, chief of the color laboratory at the Bureau of Chemistry, U. S. Department of Agriculture, resigned in November to become director of a newly-established department of general research for the Standard Oil Company of New Jersey.

Dr. Swarna Kumer Mitra, B.S., M.S. (California), Ph.D. (Ohio State), a native Hindu from Calcutta, has been appointed in the Imperial Agricultural Department of India as provisional economic botanist of Assam. Dr. Mitra sails for India early in January.

We learn from the *Journal* of the Washington Academy of Sciences that Mr. H. Pittier, of the U. S. Department of Agriculture, who is at present in Venezuela, will accompany a party of Swiss engineers who are expected in Venezuela in January for the purpose of investigating doubtful points of the Venezuela-Colombia boundary as recently arbitrated by the King of Spain. The commission will traverse the territory extending from a point on the Rio Meta to the headwaters of the Guainiia in the Rio Negro basin, a region which has probably never been visited by naturalists.

Professor Simon H. Gage spoke on November 30 before the Cornell University chapter of the Society of Sigma Xi at its first public lecture of the year. He described his recent investigations on the determination of the digestion and assimilation of fatty foods by a study of the blood with the dark-field microscope.

Baron Gerard de Geer addressed the Geological Society of Boston on November 30, on

"Spitzbergen as the key to the relation between northern Europe and North America."

THE department of physics of the Carnegie Institute of Technology recently held an evening session of its physics colloquium, at which more than a hundred guests, largely engineers and scientific men of the district, were present. The speakers of the occasion were Dr. Heber D. Curtis, the newly appointed director of the Allegheny Observatory, and Dr. Keivin Burns, astronomer. Dr. Curtis spoke on "Future work on the Einstein theory." Dr. Burn's subject was "The stars and physics."

DR. H. DESLANDRES, president of the Paris Academy of Sciences, gave, at the meeting on October 4, an *éloge* on Sir Norman Lockyer, who was a correspondent of the academy in the section of astronomy.

THE death is announced at the age of seventy-six years of Dr. Théodore Flournoy, formerly professor of physiology and psychology at the University of Geneva.

THE second annual meeting of the Mineralogical Society of America will take place in Chicago, on December 29, 1920. By a recent vote of the Geological Society of America, the Mineralogical Society of America was closely affiliated with it.

AT the Chicago meetings papers on genetical subjects will be presented at the Wednesday morning session of the Botanical Society of America, and at the Wednesday afternoon session of the American Society of Zoologists. These two sessions, together with the meetings of the American Society of Naturalists on Thursday and Friday, provide a nearly continuous program for those interested primarily in genetics and evolution. The annual dinner of the naturalists will be held Thursday evening, at the Hotel Sherman. At the close of the dinner Dr. Jacques Loeb will deliver the presidential address, "On Osmosis." A smoker for all biologists will be held Tuesday evening in the social rooms of Ida Noyes Hall, following the address of Professor W. M. Wheeler, retiring vice-president of the American Association and chairman of Section F.

A SPECIAL attraction to members of the association, and to others in attendance at Chicago will be an exceptionally interesting exhibit and working demonstration showing the apparatus and scientific principles upon which the wireless telephone is based. This collection of working models has been designed to reproduce the more fundamental discoveries in unapplied science which have paved the way for the wireless telephone and without which this great practical achievement could not have been realized. The exhibit comprises many exceedingly ingenious and spectacular automatically demonstrating models. It is especially valuable as a concrete illustration of the manner in which abstract scientific study has always had to precede practical achievements. The history of the wireless telephone as here set forth emphasizes a great principle of human progress, that the abstract scientist and reclusive philosopher of one generation prepares the way for the technician of the next; the scientific laboratory of one generation becomes the workshop of the next; the "useless theory" of one is the practise of the next. The exhibit has been prepared by the American Telephone and Telegraph Company and by the Western Electric Company, under the auspices of the National Research Council, and it has been made possible to have it at Chicago for the association meeting through the efforts of Dr. Vernon Kellogg, permanent secretary of the National Research Council, and of Dr. H. E. Howe, chairman of research extension of the council. The exhibit may be inspected at the Chicago Art Institute (Michigan Avenue near the Van Buren Street Station of the Illinois Central Railway).

THE Austin Section of the Southwestern Geological Society meets at the University of Texas, Austin, on the first Friday night of each month. The program for the present session is as follows:

October 1, 1920: F. B. Plummer, "Oil structures in the great basin of Utah."

November 5, 1920: J. W. Beede, "Geology of the Mackenzie River district."
December 3, 1920: Ira Edwards, "Geological field work in Wisconsin."
January 7, 1921: W. S. Adkins, "The Solitario."
February 4, 1921: H. P. Bybee, "The Hewitt, Oklahoma, oil field."
March 4, 1921: R. A. Liddle, "Faulting and structure in Medina County, Texas."

In an editorial note *Nature* says: There can be no doubt that scientific progress in relation to agriculture has been seriously hampered in the past by the poor material prospects offered to the scientific worker, and the Ministry of Agriculture, in recognizing the fact and in attempting to remove the defect, has shown a spirit of enlightened goodwill which is of hopeful augury. The provision of a grant earmarked to cover the salaries of workers in universities and in institutions such as the Rothamsted Experimental Station, in addition to, and separate from, a grant for laboratory and general research expenses, is a real effort to ensure that the workers shall have some security of tenure and some prospect of a settled career in the prosecution of research. The principle is sound, but the practical application is as yet not entirely successful. A system of grading the workers is perhaps inevitable, and the salaries allotted to the different grades are in some respects not reasonable. But the annual increments are too small, espceially during the years when the average worker is marrying and his expenses are increasing, and there is not sufficient range between the extremes of the scale, *e.g.*, a worker recently graduated and beginning his career receives £450; the same man ten years later, with a wife, two or more children, and a position to maintain, receives only twice that amount, and is actually worse off than before. The total number of graded posts is much too small even to cover only those already working in agricultural research. That will, no doubt, be improved as time goes on, but meanwhile it leads to stagnant promotion and invidious selection. There must be something seriously at fault when (to take only one particular instance) a worker of more than thirteen years' experience in research, of acknowledged eminence and authority in an important subject, should be offered, and have in the meantime to accept, a post in the third grade (called "junior assistants"), and be classed along with those at the start of their career with no record of solid achievement behind them.

According to the Dublin correspondent of the *Christian Science Monitor* the nineteenth annual report of the Department of Agriculture and Technical Instruction for Ireland has just been issued showing how its annual income of £190,000 has been spent. Agricultural purposes alone absorb £124,000 of this, £55,000 being reserved for technical instruction, and £10,000 for fisheries. During the academic year 1918–1919, 258 students attended the Royal College of Science. In addition to these there were three research students. As a result of the war there was a temporary decline in the attendance of readers at the National Library of Ireland. Many valuable additions have been made to this library. Visits to the Museum of Science and Art showed an increase from the previous year of neary 24,000 and many of these were serious students. There is a growing demand for homegrown timber, consequent on the reduction of supplies from abroad during the war, which demonstrates the inadequate provision hitherto made for the encouragement of forestry. The reconstructive committee, therefore, has turned its attention in this direction and the result of an investigation has been given effect to in the Forestry Act which came into force on September 1, 1919. The Forestry Act provides for the formation of a forestry fund amounting to £3,500,000 during the next ten years and the appointment of eight commissioners whose duty it will be to promote the interest of forestry and its developments, and the production and supply of timber. The powers and duties of the Agricultural Department are to be transferred to these commissioners. To assist them in their duties under the act provision is made for the appointment of four consultative committees, one of which will deal with Ireland.

UNIVERSITY AND EDUCATIONAL NEWS

IT is stated in *Nature* that the first list of donations in response to the appeal of the University of Birmingham for £500,000 shows gifts or promises to the amount of more than £250,000. Nearly half of this amount is given to the Petroleum Mining Endowment Fund. The largest single gift is an anonymous one of £50,000 for the general fund. A sum of £5,000 is for a chair of Italian, and an equal amount is given by the James Watt Memorial Fund for a James Watt research chair in engineering.

ASSISTANT PROFESSOR EUGENE TAYLOR, of the University of Wisconsin, has been appointed professor and head of the department of mathematics at the University of Idaho.

DR. J. C. WITT, assistant professor of analytical chemistry in the University of Pittsburgh, has resigned, to become chief research chemist for the Portland Cement Association with headquarters in Chicago. Dr. C. J. Engelder, of Hornell, N. Y., has been appointed to the position at the University of Pittsburgh.

MR. WILLIAM B. BROWN, associate physicist of the aeronautic power plants section of the Bureau of Standards, has been appointed instructor in physics at the Ohio State University.

DR. RODNEY B. HARVEY has resigned as plant physiologist, bureau of plant industry, Washington, D. C., to accept the position of assistant professor in plant physiology at the University of Minnesota and assistant plant physiologist in the Minnesota experiment station.

DR. BENJAMIN SCHWARTZ, assistant zoologist in the Bureau of Animal Industry, has been appointed professor of protozoology and parasitology in the University of the Philippines and will sail for Manila late in December.

DISCUSSION AND CORRESPONDENCE

HELIUM AND HYDROGEN MODELS

TO THE EDITOR OF SCIENCE: In a communication to the SCIENCE issue of June 18 Dr. Irving Langmuir proposed a model of the helium atom consisting of a nucleus of charge $2e$ accompanied by a pair of electrons which execute symmetrical oscillations about two nearly circular arcs on opposite sides of the nucleus. In the issue of November 5 he has proposed a similar model for the hydrogen molecule, and another, of a somewhat different type, for the positively charged H_2 ion. The writer was particularly interested in these models, for in each case the resultant angular momentum is zero, a circumstance which seemed to offer an explanation of the diamagnetic behavior of helium and hydrogen, and of the failure of the theories of the specific heat of hydrogen based on the assumption that the molecule is gyroscopic.

Unfortunately, Dr. Langmuir did not see how to apply the Wilson-Sommerfeld quantum conditions to the determination of the energies of these models, and therefore was not able to fix the theoretical energies and ionization potentials definitely. These quantum conditions are

$$\begin{aligned} \int \rho_1 dq_1 \equiv \int \left(\frac{\partial T}{\partial \dot{q}_1}\right) dq_1 &= n_1 h, \\ \int \rho_2 dq_2 \equiv \int \left(\frac{\partial T}{\partial \dot{q}_2}\right) dq_2 &= n_2 h, \\ \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot &, \end{aligned} \tag{1}$$

where T is the kinetic energy of the atom or molecule, q_1, q_2, . . . are a properly chosen set of coordinates, p_1, p_2, . . . , are the corresponding momenta, and n_1, n_2, . . . are any integers. Each integral is to be extended over a complete cycle of values of the corresponding coordinate. Dr. Langmuir states that he is unable to apply these equations to his models[1] because he does not know what systems of coordinates to use. The choice of a proper coordinate system is not essential, however, to the application of these conditions to the type of problem under consideration. For whatever coordinates are used, they will have a common period t, which makes possible a con-

[1] With the exception of the positive H_2 ion. He does apply the conditions to this model, and correctly, but expresses doubt concerning the validity of the somewhat unsatisfactory result on account of his uncertainty regarding the coordinate system.

venient combination of the conditions. The set of equations (1) can be written in the form

$$\begin{aligned} \int_0^\tau \frac{\partial T}{\partial \dot{q}_1}\dot{q}_1 dt &= n_1 h, \\ \int_0^\tau \frac{\partial T}{\partial \dot{q}_2}\dot{q}_2 dt &= n_2 h, \\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ &\cdot. \end{aligned} \tag{2}$$

Adding, we obtain

$$\int_0^\tau \left[\frac{\partial T}{\partial \dot{q}_1}\cdot\dot{q}_1 + \frac{\partial T}{\partial \dot{q}_2}\dot{q} + \cdots\right] dt = (n_1+n_2+n_3+\cdots)h.$$

By Euler's theorem for homogeneous functions, the integrand of the left hand member is equal to twice the kinetic energy. Consequently this integral is equal to the action of the system for the type of motion under consideration. Denoting the sum of the integers n_1, n_2, etc., by n, we have

$$A = \int_0^\tau 2T dt = nh; \quad n = (0), 1, 2, \cdots. \tag{3}$$

This integral is invariant of the choice of coordinates and can be evaluated easily if the orbit and potential energy function are known. Equation (3) is not equivalent to the quantum conditions (1), but it is a deduction from them for the type of problem under consideration, which is sufficient to fix the possible energy values of the atom or molecule. In the normal state the atom will have the least energy possible and the quantum number n should therefore be small, though the value zero must be ruled out if there is to be any dynamic equilibrium at all. In the case of the helium atom or the hydrogen molecule, it is to be expected that n will be either one or two.

I have carried through the numerical evaluation of the action integral for the helium atom model and regret to say that the calculation shows that if the atom is given an energy corresponding to its ionization potential, the quantum condition (3) is *not* satisfied.

In making the calculation I have used an approximate expression for the path of the electron. This is permissible, since, by the principle of least action, the variation in the integral produced by a small variation in the path, holding the total energy constant, vanishes to small quantities of the first order. The determination of the approximate path was based on the data furnished by Dr. Langmuir. He says that the path of each electron is very nearly an arc of an eccentric circle subtending an angle of 155° 56′ at the nucleus. The radius vector from the nucleus to the midpoint of the orbit is 0.2534×10^{-8} cm. for an ionization potential of 25.59 volts, and the radius vector at the end of the orbits is 1.138 times as great. By expanding the expression for the radius vector into a power series in θ (the angle between the momentary radius vector and the radius vector to the midpoint), and discarding higher power terms, it is easy to show that an equation of the form

$$r = r_0(1 + k\theta^2) \tag{4}$$

can be used to define an approximate orbit. Here r_0 is 0.253×10^{-8} cm. and k is easily calculated from the known values of r and θ at the end of the path.

The expression for the potential energy of the system is

$$\Phi = -\frac{4e^2}{r} + \frac{e^2}{2r\cos\theta}, \tag{5}$$

where e is the charge on the electron. The total energy W is easily calculated from the above equation by inserting the values of r and θ for the end of the path. The kinetic energy of the two electrons is

$$T = W - \Phi = mv^2. \tag{6}$$

By means of equations (5) and (6) the expression for the action is easily transformed into the form

$$\begin{aligned} A &= 4\int_0^{s_m} 2mv\,ds \\ &= 8e\sqrt{m}\int_0^{s_m} \sqrt{\frac{4}{r} - \frac{1}{2r\cos\theta} - \frac{W}{e^2}}\cdot ds, \end{aligned} \tag{7}$$

where s is the rectified length of the path from its midpoint to the point (r, θ), and s_m is the maximum value of s. The graphically determined value if the integral which forms the right hand member of (7) is 1.57 h. This result is in conflict with the quantum condition (3) and shows that if the quantum conditions (1) are correct, the Langmuir model of the

helium atom will not account for the observed ionization potentials of that element.

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REPRINTS FROM SCIENTIFIC INSTITUTIONS

THE librarian is not alone, I imagine, in considering the bound scientific reprints issued as contributions from a given laboratory, most difficult to handle. There should really be no place for articles already published to appear except as reprinted separates. Without doubt, a bound volume of the publications of an institution serves as a report of the work done. But a list of the authors and titles of papers with the place and time of publication would serve this purpose just as well or better. Certain universities issue such lists of the publications of their staffs, and give these lists under the different departmental heads. This seems eminently worth while even where the number of publications in a department is scant.

The department of physiology of one university and the department of botany in another send to this library serial lists of their publications and with the lists the separates themselves, placed in order in a folder. This seems as nearly a perfect method as can be devised. The lists may be filed in any convenient way and the separates dealt with according to the method found most useful to the recipient. The expense of binding is saved to the institution issuing these separates, and while the distribution of the separates may be selective, the printed lists can be given a wide publicity. Such lists if issued very generally would make useful bibliographies and could be systematically filed. At the same time, the departmental library, so important in these days of disappearing private libraries, would have to handle a given article but twice, the original in journal form and the separate.

PRISCILLA B. MONTGOMERY
ASSISTANT LIBRARIAN,
MARINE BIOLOGICAL LABORATORY,
WOODS HOLE, MASS.

OBSERVATIONS ON THE PHILOSOPHY AND ETHICS OF RESEARCH AND PUBLICATION

TO THE EDITOR OF SCIENCE: Dr. Erwin F. Smith may have performed a service to the plant pathologists in publishing his "Introduction to bacterial diseases of plants," as I have no doubt he has; but he has surely performed a service to scientists everywhere, of every denomination, in publishing the last chapter of that book, "Part V. General Observations." In this he has collected the results of observation in the realms of the literature of science, the scientific method, the life of science and the science of life, all of which really does not express the material he has there collected. A catalogue of the headings the author has used will be more revealing. Here they are:

On subsidiary studies
On seeing things
On experimentation
On beginning work thoughtlessly
On interpretation of phenomena
On repetition of experiments—other people's, one's own
On publication
On clearness in presentation
On brevity of statement—when brevity is not desirable
On the ethics of research
On keeping one's own counsel
On team work
On sharing credits
On attending meetings and keeping up membership in societies, and on being generally public-spirited and helpful in science
On rest and recreation

The student of science will find here counsel of the greatest value on such a subject as the preparation of a paper. Would that I might quote all that he says! "Many a big book could have been boiled down to a few chapters, and in some cases to a few sentences, or to nothing at all, had its author been possessed of *clear ideas*." "Easy writing is hard reading." ". . . it is your solemn duty to sum up the substance of your contribution in a series of brief conclusions which everyone will read, and which, if well put, may induce many to turn back and read your whole

paper." "Either journals should publish no abstracts whatever, or else exact, useful ones." ". . . before you have gone very deep into any subject search out the literature of it and prepare a proper bibliography."

These are some aphorisms that strike one who is interested in the literary side of science. Ethics and philosophy as Dr. Smith relates them to science are equally intriguing. The value of this chapter, which appears unassumingly at the end of the book, is such that the attention of every student of science is earnestly invited to it.

Frank Place, Jr.

THE DIRECTORSHIP OF THE MAINE AGRICULTURAL STATION

The Maine Agricultural Experiment Station is by act of legislature created as a department of the University of Maine. Its governing board is the trustees of the university. The director reports to the president of the university. The heads of the station departments report to the director. At the reorganization of the station in 1888 the trustees created a representative body to be called the station council for "the development and management of the station."

By act of legislature the experiment station was directed to conduct investigations into animal husbandry. The prime object was to try to learn how milk production and milk fat production are inherited. As one part of this work a herd made up of reciprocal crosses of high and low producing cows was essential. Such a herd was developed at the university in cooperation with the College of Agriculture. In November, 1919, without consultation with the station staff or the station council the trustees ordered this investigation stopped and the animals making up the herd sold. In January, 1920, after station council action, a committee from that body waited upon the trustees and presented a plan for continuing this investigation at Highmoor Farm. This plan was unanimously approved by the trustees. Among the items approved and as taken from the trustees records of that meeting is "The plan includes the use of certain barn space at the farm and the construction of an additional barn for housing, and water supply and equipment for caring for the animals and their products." Acting under this authority the council committee and the station director immediately took steps to put this action into effect. A barn was erected, the old barn remodeled, a well drilled and equipment purchased. The building of the barn was inspected in June when it was about half completed by a committee of the trustees who were appointed by the board with full authority relative to the new construction at Highmoor Farm. The committee from the station council met with the committee from the trustees. Neither at that time nor at any time while the construction was in progress did the trustees make any suggestion as to change or modification of the trustee action of January, 1920.

November 29 without previous notice the director of the station was requested by telephone to go to Bangor to meet the board of trustees. When he appeared he was told by the president of the board that the trustees unanimously demanded his immediate resignation. On asking why, the director was informed that by building a barn at Highmoor Farm he had exceeded his authority. The director denied that he had exceeded authority and cited the paragraph from the trustee records above quoted. He refused to resign. At about 10 o'clock the morning of November 30 he received a notice signed by the clerk of the board of trustees notifying him that the trustees had removed him from being director, the removal to be effective December 1. The director spent the remainder of the 30th putting station matters in the best shape possible for leaving in the limited time. As the trustees had delegated no one to take his place and as they had ignored the president of the university in the matter by sending the communication of removal direct to the director, the director suggested to the heads of the station that they should continue to act automatically in station management as they would were the director temporarily absent. And there the matter now rests.

The Maine Station in its 35 years of existence has through its discoveries added many millions to the wealth of the state. It is the only research agency the state has for discovering the laws underlying successful agriculture. Research is slow painstaking work. The research worker must be kept from harrowing concern. For it is only by concentration on his project that success can be had. This action of the trustees has fundamentally disturbed the confidence of the research man. He argues if the director after a quarter of century of faithful work is dismissed without adequate reason, where does he stand, what hope has he of being able to complete a study that must extend over long periods of time? At no time in the history of the station does it so need the steadying hands of friends of agriculture. The last request of the removed director is to the friends of agriculture, and he is happy and proud to know they are for the most part his personal friends as well, to come to the support of the station. It has been receiving $5,000 a year from the state for its support. To tide it over until increased federal appropriations which are being asked for in a nation-wide movement are available, this amount must be increased to $25,000 a year. Otherwise it will not be possible for any one to hold the present very efficient organization together. Help will come from the outside eventually but for this help to be efficient the agriculture of the state must see to it that the legislature makes provision for its immediate support. CHAS. D. WOODS

QUOTATIONS

SCIENCE AND THE NATION

MOST of us receive daily appeals for war memorials of various kinds. Would not the best, and, in the end, the cheapest, war memorial be a growing and efficient body of brain-workers, able and willing to solve the problems which the war has left in its train, and to help the nation in its hour of need? For leaders both in peace and war we must find and train men who will be competent to use the national resources in the most effective manner. Scientific workers are naturally marked out by their progressive instincts and severe training to serve not merely in an advisory capacity in the councils of the nation, but also as executive officers. Moseley and others of his type will not have died in vain if the Cenotaph reminds us that men of science must take an active part in the affairs of state, in guiding the development and thought of the nation, and in seeing that the bitter lessons learnt during the last six years are not forgotten.

This end will not be attained by service on committees, whether for chemical warfare or any other subject. If the War Office seeks to be scientific it should establish within itself, as the Admiralty has done, a research department with distinguished men of science as permanent members of the staff to suggest and supervise work on methods of modern warfare. It would be the business of such officers to make use of science for purposes of national security, and workers in university or other laboratories could please themselves whether they cooperated or not in particular researches or experiments. We can understand the objections offered by Professor Soddy and others against men of science associating themselves as a body with problems of this type, but until human nature reaches a higher ethical plane than it occupies at present we must have a War Office, and an essential part of it should be an able scientific staff, the members of which would be responsible for making us strong enough to meet any crises which the future might bring. No committee of sixty or more associate members can do this, and none would be necessary if the War Office ranked a scientific service with the General Staff, as it should do, instead of inviting scientific workers to devote their time and knowledge to "offensive and defensive aspects of chemical warfare" for little more than out-of-pocket expenses.

We claim for science a much more responsible position, and a far higher appreciation of its worth, than our war leaders offer to it even now; and we do so because we remember that

thousands of young lives were lost through its neglect. When we bow our heads before the Cenotaph we think of the highly trained men of science who were killed at Gallipoli or drowned in the mud of Flanders while Ministers turned for advice to alchemists and circle-squarers, or confused great chemists with dispensers of drugs, and we wonder whether even now anyone in power realizes what civilization has lost through the sacrifice of creators of knowledge. While we mourn their loss, let us work and pray for the scientific enlightenment of the leaders into whose hands the destinies of the nation are entrusted, so that we may be assured of strong and effective guidance whatever is before us.—*Nature.*

SCIENTIFIC BOOKS

The Geology of South Australia. By Walter Howchin, Lecturer in Geology and Paleontology in the University of Adelaide. Published by the Education Department, Adelaide, 1918. Pp. xvi + 543.

Division I. of this book is a general review of geologic processes and principles, with illustrations drawn chiefly from the geology of Australia. Incidentally, the illustrations bring out many facts concerning Australian geology, some of which are not readily available to the general reader. For example, in the discussion of deformation, it is stated that there are two belts of "settlement" (subsidence), one meridional, giving rise to the great rift valley, the ends of which make the present great gulfs, the other along the continental shelf at the south, running northwest and southeast, its location being about where the shallow sea floor slopes down to the depths. Settlement still is in progress in both these zones, and the earthquakes of Australia, of which two have been recorded in recent times, one in 1897, and one in 1902, are connected with the sinking.

Division II. of the volume deals with the historical geology of South Australia, but, fortunately, comprehensive notes are appended concerning the geology of other parts of the continent, so that this part of the book is a summary of Australian geology, with chief emphasis on South Australia. Brief correlation notes tie up the geology of the continent with that of England. The sections dealing with the Cambrian and the Permo-Carboniferous are perhaps of greatest interest because these systems have large and instructive representation in the continent. The Cretaceous also is represented in a large way.

The volume has excellent illustrations, both photographic and diagrammatic. The illustrations of Cambrian fossiliferous limestone, p. 377, are examples of the former, and the section of Mt. Remarkable, p. 279, of the latter.

The hope may be expressed that when a second edition of the book shall appear, a little more stress may be laid on the physical events in the history of the continent, as for example, the character, extent and dates of the principal deformations. If knowledge permits their preparation, paleographic maps would be most welcome. The volume is a very useful one, and adds much to our knowledge of the geology of the continent.

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SPECIAL ARTICLES

THE COMPRESSION OF A SOUND WAVE

Lord Rayleigh and more recently Professor A. G. Webster and others have given considerable attention to this problem. The following experiment, which is, I think, capable of exact development, is a further contribution.

1. *Apparatus.*—Many years ago[1] I showed that displacement interferometry lent itself favorably to the study of a diabatic expansion and this is particularly the case when the achromatic fringes are used. It is therefore suggested that the endeavor to look with the interferometer through the nodes of an organ pipe would not be unsuccessful.

Open pipes *P,* adapted for the purpose in question, are shown in Figs 2, 3. In Fig. 2, cylindrical adjutages *pp′,* of somewhat smaller diameter than the pipe (open within, but closed by glass plates *gg* on the outside) are

[1] Carnegie Pub. 149, Ch. XI., 1912.

introduced at the node N, symmetrically and at right angles to the pipe. The effect of this is to lower the pitch to a degree increasing with the length of p. If p is not too long, one may argue that the resilience of air at the node is decreased, and the period lengthened much in the same way in which an increased capacity operates in an electric circuit. The fundamental pitch was depressed about a fourth. The first overtone however occurred at about a tenth above this and came out very shrilly, probably because it coincided with the octave of the unchanged pipe. Moreover this first overtone is probably the fundamental of the small pipes p, p'. Thus this overtone here also presents two nodes of the same kind, both compressed and both rarified, and the optic effects (ray L) are correspondingly intense.

The other form of pipe (shown in Fig. 3) has the plane of the embouchure at right angles to the axis of the pipe, which is closed at g by a knife-edged glass plate. The other end may be open, or closed with glass. The path of the interferometer beam is shown at L. Since the distribution of density is simple harmonic, the details are here quite open to computation.

Another available pipe is simply an open tube to be excited by resonance. This case is in a measure the most interesting of the three.

Finally the plan of quadratic interferometry is indicated in Fig. 1, L being a beam of white light from a collimator, with fine slit,[2] M, M', N, N', the mirrors, N and M' half silvered and identically thick. Small fringes (1/10 mm. in the ocular) suffice. The

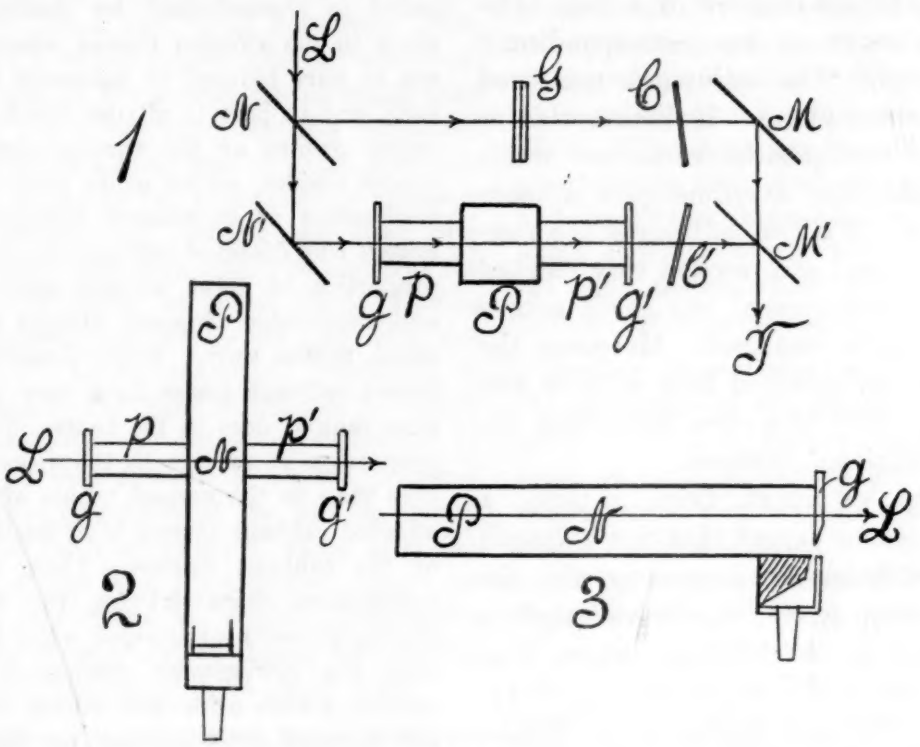

FIG. 1.

pipe is in position at $g\ p\ Pp'\ g'$ and G is a glass compensator. In order that the fringes may be of any desirable size and at any inclination (horizontal preferable), two plate compensators C, C', revolvable on vertical and horizontal axes, may be installed. If however the mirrors M', N' turn conveniently on horizontal aves, and M, N on vertical axes, the former may be used to give the fringes a horizontal trend and the latter, thereafter, for enlarging them.

When the pipe sounds sharply, the acromatic fringes necessarily vanish. Hence they

[2] The fringes at rest look like beads on a black string. There are about three colored fringes on either side of the middle one which is white.

must be observed at T by a *vibration telescope*,[3] in which case magnificent wave forms appear, measurable in amplitude.

2. *Observations.*—In the experiments, when the pipe P, Fig. 2, sounded its fundamental as softly as possible, the even horizontal band of fringes became definitely sinuous. Probably at the limit of audition there would be no response, except with much larger fringes. A strong fundamental makes the double amplitude about a fringe or more in width. The waves of the overtone are correspondingly shorter and high. The adjutages measured $l = 21$ cm. between plates. Reducing this to $l = 14$ cm. the fundamental came out much stronger, but the loud overtone gave a more confused record. Without adjutages the fundamental ($l = 5$ cm.) still evoked very marked waves, but the response of the shrill octave had naturally quite vanished. Moreover the form of the waves, obtained here without any mechanism but with the even harmonics deleted, is of additional interest.

3. *Deductions.* — Apart from details, I showed in the early paper[4] that for a length of tube l containing homogeneous air, the density increment $\Delta\rho$ for the wave-length λ may be written $\Delta\rho = (C/lR)n\lambda$, where $C = 10^7 \times 1.27$ is the optic constant $p_0(\mu_0 - 1)_0$ and n is the total fringe displacement. Hence if

$$l = 20 \text{ cm.}, \ \lambda = 6 \times 10^{-5} \text{ cm.}, \ \rho = .0013,$$
$$n = 1/10, \ \Delta\rho/\rho = 1.03 \times 10^{-3}$$

for the soft pipe note. Rayleigh considers $dp/p = 6 \times 10^{-9}$ just audible, so that my value is of a reasonable order, holding about 2.4×10^5 times more energy per average cm.^{3} ($p\ d\rho/\rho = 10^3$ ergs/cm.^{3}) than Rayleigh's limiting note. For the shorter adjutages the main energy would be correspondingly larger. An open cylindrical resonator close to an equipitched open organ pipe can just be seen to respond. Blown at its edges by a lamella of air, however, strong waves antedate the first audible sibillation of pitch. Into the variety of interesting stroboscopic effects I can not enter here.

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[3] Carnegie Publ. No. 249, III., Chap. V.; IV., Chap. VI., 1919.

[4] C. P., 149, p. 145.

THE AMERICAN CHEMICAL SOCIETY

(*Continued*)

A mosaic disease of cabbage as revealed by its nitrogen constituents: S. L. Jodidi, S. C. Moulton and K. S. Markley. The cabbage disease investigated is characterized by denitrification taking place in the affected tissues, whereby the nitrates are in part reduced to ammonia which is lost as such, and in part to nitrites which reacting on the amino groups of the various organic compounds —acid amides, amino acids, etc.—bring about the elimination of elementary nitrogen. This is the reason why diseased cabbage tissues have a smaller proportion of total, nitrate, acid amide, diamino and monoamino nitrogen, nitrites occurring in diseased tissues only. Denitrification occurs in affected cabbage leaves in a very much higher degree than it does in the roots. There is a higher proportion of protein in the diseased cabbage tissues than in the normal. Loss of nitrogen in the affected cabbage tissues is in itself an explanation of the cabbage disease. Thus, *e.g.*, one of its conspicuous characteristics, the dwarfing of the plants, is easily understood when we bear in mind that the nitrogenous compounds such as acid amides, amino acids and others, which are partly lost through denitrification, are the very materials out of which the plant is building up its tissues. In the healthy cabbage samples the nitrogen is made up, in round figures, of 30 per cent. protein nitrogen, 7 per cent. diamino nitrogen, 10 per cent. mono-amino nitrogen, and 13 per cent. peptide nitrogen, which means that at least 13 per cent. of the nitrogen compounds present in cabbage have direct nutritive value.

The influence of the diet of the cow upon the fat soluble and water soluble vitamine of cow's milk: R. Adams Dutcher, Cornelia Kennedy and C. H. Eckles. Albino rats were fed purified diets containing casein, dextrin, agar, butter fat, wheat embryo extract and an adequate salt mixture. Varying quantities of winter milk and spring milk were fed with diets containing no added butter fat and with other diets containing no embryo extract. It was found that spring milk is superior growth-promoting properties with regard to both the fat soluble and the water soluble vitamine.

When the milk is at its best 10 c.c. will furnish sufficient water soluble and fat soluble vitamine for normal growth in the albino rat. When winter butter fat was fed it required 20 per cent. of this fat in the ration to furnish sufficient fat soluble vitamine for growth. Several rats lost weight and died while being fed a diet containing 20 per cent. of winter butter fat.

The influence of the diet of the cow upon the antiscorbutic and nutritive properties of cow's milk: R. ADAMS DUTCHER, C. H. ECKLES, C. D. DAHLE, S. W. MEAD and O. G. SCHAEFER. Two cows were fed a vitamine-poor type of winter ration for a period of five months during which time the milk was fed in varying quantities to guinea-pigs which received a basal diet of oats. New sets of pigs were added as the experiment progressed. After five months the diet of the cows was changed abruptly to a high vitamine diet and the cows were given access to green grass. During this period several sets of guinea-pigs were fed as in Period I. As we announced previously, it was found that spring milk is superior to winter milk in antiscorbutic and nutritive properties. It was also found that there is a decided tendency for the nutritive properties of the milk to remain relatively good for four to eight weeks after the cow has been placed on a vitamine-poor winter ration. On the other hand, the nutritive superiority of spring milk became evident almost immediately after the cows were placed upon green grass.

The influence of the diet upon the growth and development of testes and adrenals in White Leghorn cockerels: R. ADAMS DUTCHER and S. D. WILKINS.

Further observations on the antineuritic properties of chemical substances: R. ADAMS DUTCHER, G. E. HOLM and HARLOW BIERMAN. We have noted, in a previous publication, the fact that thyroxin (the thyroid hormone) possesses antineuritic properties. Due to the fact that this compound contains an indol nucleus, we have extended our studies to other indol derivatives. Thus far we have been able to demonstrate that α-keto-β-propyl-indol possesses decided antineuritic properties. Similar observations were made in the case of N methyl-β-ethyl-indolinon. Negative results were obtained with N methyl-β-methyl-indolinon and α-phenyl-β-methyl-indol.

A study of certain physico-chemical and colloidal properties of the glutens from strong and weak flours: PAUL FRANCIS SHARP and ROSS AIKEN GORTNER. Gluten from flours of widely differing quality were studied with respect to (1) rate and extent of imbibition in the presence of acids, (2) rate of imbibition in the presence of alkalis, (3) the effect of salts on imbibition in alkalis, (4) the gold number of the gluten, (5) the binding capacity of the gluten as measured by titration and by the potentiometer, (6) the specific conductance of gluten sols dispersed in dilute alkali, (7) the viscosity of the gluten and gluten sols, (8) the isoelectric points of the various glutens, and (9) the effect of drying in vacuo on the physico-chemical properties of the gluten The results indicate that there are marked differences in the physico-chemical colloidal properties of the different glutens in addition to those which have already been observed in rate of imbibition and imbibition capacity. Apparently the colloidal condition of the gluten is at least one of the major factors which must be considered in the problem of flour strength.

Further observations on the relation between the imbibition of the gluten and the strength of wheat flour: C. H. BAILEY and S. D. WILKINS. A study of flours of varying degrees of strength indicate that low strength is not necessarily attributable solely to inferior quality of gluten as indicated by lower hydration capacity of the latter in the presence of dilute acids. Low percentages of gluten contribute to a general reduction of baking strength, other things being equal. Occasionally, however, a low gluten flour will possess a baking strength above the average of its type, in which an abnormally high quality of gluten is generally indicated by its high hydration capacity. It is further probable that the complex known as strength is influenced by the quantity and character of yeast nutrients and fermentable material in the dough. The strength of flours which are normal in other particulars seems to be depressed by deficiencies in yeast nutrients.

Some observations upon the isolation of cystine from keratins: GEORGE E. HOLM and WALTER F. HOFFMAN. Cystine could not be prepared from human hair washed in hot dilute sodium carbonate solution, while from hair washed in cold dilute sodium carbonate solution cystine was easily obtained. Hair heated with 1 per cent., 2 per cent. and 4 per cent. Na_2CO_3 for 1, 2, 4, 8 and 16 hours removed from 6 per cent. to 55.67 per cent. of the S, while very little hydrolysis, measured by amino nitrogen occurred. Pure cystine treated in the same manner (2–8 hours) lost 1.7–14 per cent. of

its sulphur, 20 per cent. of its amino nitrogen and changed considerably in its specific rotatory power.

Biochemistry of plant diseases. III Effect of the brown rot fungus on plums: J. J. Willaman and M. Sandstrom. Five varieties of plums were subjected by rotting by *Sclerotinia cinerea.* The changes in composition of the tissue were characterized by (1) an increase in the P_H values, (2) a decrease in the titre, (3) a decrease in the malic acid, (4) formation of oxalic acid, (5) marked decrease in tannin. The ratio of protein to non-protein nitrogen increases during rotting and during the ripening of the plums.

The apparently specific effect of ammonia in the oxidation of butyric acid with hydrogen peroxide: Edgar J. Witzemann. Ammonium butyrate in dilute aqueous solution in the presence or absence of excess ammonium hydroxide is readily oxidized by hydrogen peroxide. Sodium or potassium butyrate in the presence of absence of excess of the alkali hydroxide is scarcely oxidized at all by hydrogen peroxide. These facts are of especial interest because they offer a new and rational interpretation of the interrelation of increased urinary ammonia and increased fat and protein oxidation in acidosis. The fact that large amounts of acetone are obtained in this oxidation of ammonium butyrate, as was shown also by Dakin in 1908, supports the application of the results to the interpretation of acidosis metabolism.

Antibody studies—Part 3. A preliminary report on the chemical nature of bacterial antibodies? F. M. Huntoon, Peter Masucci and E. Hannum. Presented by Peter Masucci. Bacterial suspensions were sensitized with specific serum. The protective antibodies were removed from the sensitized antigen by various solvents. The resultant solution was filtered through a candle and its protective antibody content determined by the U. S. Hygienic Laboratory method for testing the potency of anti-pneumococcus serum. Direct and indirect chemical methods as well as biological methods used show that protective antibodies are colloidal in nature, are not soluble in ether, and do not belong to the globulin group of serum proteins. They are not destroyed by the action of trypsin over long periods of time, and are not affected by certain dilute acids and alkalies or 30 per cent. sodium chloride solution. Heat above 60° C. progressively destroys or alters their nature. We may state that antibodies do not belong to that group of proteins usually considered under the head of serum proteins.

The non-catalase decomposition of hydrogen peroxide by aromatic hydrocarbons and their derivatives: Sergius Morgulis and Victor E. Levine. The experiments arose from the accidental observation that an enzyme preparation preserved with toluene had acquired a remarkably increased capacity for decomposing hydrogen peroxide. Euler and Blix have recently published the fact that yeast catalase is activated by toluene. The idea of an activation of the enzyme by toluol seems entirely improbable, for we have found that toluene alone even in minute quantities decomposes hydrogen peroxide. The action of toluene is also characteristic of other hydrocarbons of the benzene group. These compounds form a series, according to the number of methyl radicles attached to the ring, with a gradually decreasing power to decompose hydrogen peroxide, thus Benzene > Toluene > Xyluene > Mesitylene. The reaction is not general for aromatic hydrocarbons but is specific for those of the benzene series. Hydrocarbons with more than one benzene ring, like diphenyl, diphenylmethane, benzidine, naphthalene, anthracene and heterocyclic compounds do not react. The introduction into the ring of a COOH group, $NHNH_2$ group or one or more phenol groups renders the hydrocarbon incapable of decomposing hydrogen peroxide. The substitution of a nitro, amino or aldehyde group, or of a halogen atom for hydrogen does not prevent the breaking up of hydrogen peroxide, although the catalytic power of such substituted compound is much less than that of the corresponding hydrocarbon. The decomposition of hydrogen peroxide by aromatic hydrocarbons and their derivatives is not caused by changes in surface tension.

Charles L. Parsons,
Secretary

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